

We claim:

1. An optical apparatus for investigating a fluid stream, comprising:

an optical fiber having a distal end, said distal end of said optical fiber comprises a substantially cubical corner defined by three planes substantially perpendicular to each other.

2. An optical apparatus according to claim 1, wherein:

a diagonal of said cubical corner is aligned with a longitudinal axis of said optical fiber.

3. An optical apparatus according to claim 1, wherein:

an incident angle of light at each of said three planes is $54.73^\circ \pm 1^\circ$.

4. An optical apparatus according to claim 1, wherein:

said optical fiber terminates at a sharp tip where said three planes meet.

5. An optical apparatus according to claim 1, wherein:

said optical fiber terminates at a rounded corner.

6. An optical apparatus according to claim 5, wherein:

said three planes define three lines where respective sets of two of said three planes meet, and said optical fiber is rounded at each of said three lines.

7. An optical apparatus according to claim 1, wherein:

said optical fiber has a base adjacent cubical corner, said base tapering in diameter from a larger to a smaller diameter as said fiber extends distally towards said cubical corner.

8. An optical apparatus according to claim 7, wherein:

said taper is less than 10° .

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9. An optical apparatus according to claim 7, wherein:
said taper is at most 5° .
10. An optical apparatus according to claim 1, wherein:
said optical fiber has a diameter of between 0.2 mm and 0.4 mm.
11. An optical apparatus for investigating a fluid stream, comprising:
an optical fiber having a distal end, said distal end of said optical fiber comprises a cone having a face angled at $45^\circ \pm 2^\circ$ relative to a longitudinal axis.
12. An optical apparatus according to claim 11, wherein:
said optical fiber terminates at a sharp tip.
13. An optical apparatus according to claim 11, wherein:
said optical fiber terminates at a rounded tip portion, said rounded tip having a diameter at most twenty-five percent of a width of said optical fiber at a base adjacent said cone.
14. An optical apparatus according to claim 11, wherein:
said optical fiber has a base adjacent said cone, said base tapering in diameter from a larger to a smaller diameter as said fiber extends distally towards said cone.
15. An optical apparatus according to claim 14, wherein:
said taper is less than 10° .
16. An optical apparatus according to claim 14, wherein:
said taper is at most 5° .
17. An optical apparatus according to claim 11, wherein:
said optical fiber has a diameter of between 0.2 mm and 0.4 mm.

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18. An optical apparatus for investigating a fluid stream, comprising:

an optical fiber having a distal end, said distal end of said optical fiber comprises either a paraboloid or a portion of a sphere.

19. An optical apparatus according to claim 18, wherein:

said distal end of said optical fiber comprises a hemisphere.

20. An optical apparatus according to claim 18, wherein:

said optical fiber has a base adjacent said paraboloid or sphere, said base tapering in diameter from a larger to a smaller diameter as said fiber extends distally towards said paraboloid or sphere.

21. An optical apparatus according to claim 20, wherein:

said taper is less than 10° .

22. An optical apparatus for investigating a fluid stream, comprising:

an optical fiber having a distal end, said distal end of said optical fiber having an numerical aperture of less than 0.3.

23. An optical apparatus for investigating a fluid stream, comprising:

a) an elongate body;

b) a light source; and

c) a plurality of optical probes coupled to said elongate body and to said light source, said plurality of optical probes including at least one probe comprising an optical fiber having a distal end arranged as either

(i) a substantially cubical corner defined by three planes substantially perpendicular to each other,

(ii) a paraboloid or a portion of a sphere.

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24. An optical apparatus according to claim 23, wherein:

said plurality of optical probes includes a first probe comprising an optical fiber having a distal end arranged as either a substantially cubical corner defined by three planes substantially perpendicular to each other or a cone having a face angled at $45^\circ \pm 2^\circ$ relative to a longitudinal axis, and a second probe comprising an optical fiber having a distal end arranged as a paraboloid or a portion of a sphere.

25. An optical apparatus for investigating a fluid stream, comprising:

- a) an elongate body;
- b) a light source; and

c) a plurality of optical probes coupled to said elongate body and to said light source, said plurality of optical probes including a first probe comprising an optical fiber having a distal end arranged to provide a numerical aperture of below 0.3 and a second probe comprising an optical fiber having a distal end arranged to provide a numerical aperture of above 0.8.

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